NON-PUBLIC?: N
ACCESSION #: 8804270237
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Quad-Cities Nuclear Power Station, Unit Two PAGE: 1 of 6

DOCKET NUMBER:
5000265

TITLE: Unit Two Reactor Scram Due to Feedwater Regulating Valve Packing Failure
EVENT DATE: 03/20/88 LER #: 88-005-00 REPORT DATE: 04/11/88

OPERATING MODE: 4 POWER LEVEL: 045

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: SJ COMPONENT: LCV MANUFACTURER: C600
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: On March 20, 1988, Quad-Cities Unit Two was in the RUN mode at 45 percent thermal power. At 0123 hours, a reactor scram (and related Engineered Safety Feature actuations) occurred due to a spurious turbine trip caused by a packing leak on 2B Feedwater Regulating Valve (FRV). The leakage caused a short across terminal contacts in Busses 21 and 22 that cause the turbine to trip. A group I isolation also occurred during this event. NRC notification via the Emergency Notification System was completed at 0215 hours per 10 CFR 50.72.

The cause of this event is attributed to component failure (packing on 2B FRV). Contributing to this event is the lack of administrative controls to ensure valve packing is replaced prior to failure.

Corrective actions included repairs and inspection of both FRVs and moisture removal and inspection of affected equipment. Additional corrective actions include: 1) Disassembly and repair of the 2B FRV during the Refuel outage, 2) vibration isolator installation on Group I instrument racks, 3)

development of guidelines for packing replacement, 4) evaluation of area floor drain system and area cable pan covers, and 5) round sheets revision to ensure once/shift inspection of FRV. This report is supplied per 10 CFR 50.73 (a)(2)(iv).

(End of Abstract)

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power. Energy Industry Identification System (EIIS) codes are identified in the text as (XX).

EVENT IDENTIFICATION: Unit Two Reactor Scram due to Leaking Feedwater Regulating Valve.

A. CONDITIONS PRIOR TO EVENT:

Unit: Two Event Date: March 20, 1988 Event Time: 0123 Hrs
Reactor Mode: 4 Mode Name: RUN Power Level: 45%

This report was initiated by Deviation Report D-4-2-88-015

RUN Mode (4) - In this position the reactor system pressure is at or above 825 psig, and the reactor protection system is energized, with APRM protection and RBM interlocks in service (excluding the 15% high flux scram).

B. DESCRIPTION OF EVENT:

At 2215 hours on March 19, 1988, Unit Two was in the RUN mode under Economic Generation Control (EGC) at approximately 86 percent reactor thermal power. At this time, the Shift Engineer (SE) received a report from personnel in the turbine building of water dripping on Reactor Feedwater Pump (RFP) (SJ, P), 2C-3201. A Shift Foreman (SF) was sent to investigate. At 2240 hours, the SF reported to control room personnel that water was spraying from the packing of Feedwater Regulating Valve (FRV) (SJ, LCV), 2-642B. The SF had attempted to tighten the packing of the valve but there was no take-up left in the packing.

The FRV's consist of two 100 per cent capacity valves, one air-operated, fluid-dampened (2-642A), (SJ, LCV) and one hydraulically operated (2-642B). These two valves are installed in parallel to one another and also in parallel to one 20 per cent capacity minimum flow

valve (2-643) (SJ, LCV) which is air-operated and normally only used during unit startup but otherwise remains closed by maintaining the setpoint slightly below normal level. At normal reactor (RCT) power levels, the A FRV is set to one position and reactor water level is controlled with the B FRV.

At 2310 hours on March 19, 1988, the Unit Two Nuclear Station Operator (NSO) opened the 2A FRV from approximately 20 percent to 30 percent open which allowed the 2B FRV to regulate at a different position in valve travel. The SF reported that the leak had slowed considerably. At 2343 hours, Unit Two was taken off of EGC and reactor power was held steady at approximately 86 percent reactor thermal power to maintain the 2B FRV at a position where the packing leakage was minimal. Maintenance personnel were notified at home and told to report in the morning to repack the leaking valve. At 2344 hours on March 19, 1988, the Unit Two NSO adjusted the 2A FRV to approximately 35 per cent open which lowered the 2B FRV to approximately 20 percent open. Also, the minimum flow valve was set to control

reactor water level to minimize oscillations of the 2B FRV. The SF reported that the leak was now reduced to a "whisp." The SF then left the area to return to other duties.

At 0045 hours on March 20, 1988, the control room began receiving fire alarms (FRA) from the turbine building (NM) mezzanine area where the FRV's are located. This was immediately followed by reports from personnel in the turbine building of steam coming up the stairwell on the floor above the mezzanine floor. The Unit Two NSO initiated an immediate load reduction (120 megawatts electric per hour). A SF and Equipment Attendant (EA) were sent to investigate and the Radiation Chemistry Department was notified. At 0055 hours, the SF reported that steam was blowing badly from the 2B FRV. At 0103 hours on March 20, 1988, the Unit Two Reactor Recirculation Pumps (AD, P) were at minimum speed and the reactor at approximately 53 percent thermal power. The 2B FRV upstream isolation motor-operated valve, 2-3206B (SJ, ISV) was closed and operating personnel closed the downstream manual isolation valve, 2-3209B (SJ, ISV).
At 0106 hours on March 20, 1988, the Unit Two NSO began increasing load with the 2B FRV isolated. At 0110 hours, the reactor was at approximately 60 percent reactor thermal power when the following alarms were received in the control room: Reactor Feed Pump (RFP) (SJ, P) Auto Trip, RFP Vent Fan (SJ, FAN) Auto Start and RFP Vent Fan Auto Trip. The NSO checked the RFP's and all indications appeared normal. At 0115 hours, RFP/Turbine reactor vessel (VSL) High Level

(LA) and 4kV Bus 21/22 (EA, BU) Low Voltage alarms (EA) were received. Both Bus voltages and vessel level were within acceptable ranges and the alarms reset immediately. The NSO reduced Recirculation Pump speed to minimum and began inserting control rods in sequence.

At 0123 hours on March 20, 1988, Unit Two was in the RUN mode at approximately 45 percent reactor thermal power when a turbine (TA) trip occurred due to reactor vessel high water level signal. This resulted in a reactor scram (JC) due to turbine stop valve closure and was accompanied by a Group I isolation (JM). The reactor water level transient following the scram saw vessel level drop below the reactor low water level setpoint (+8 inches) which resulted in the following actuations:

1. Control room ventilation (VI) changed to 100 per cent recirculation.

2. Standby Gas Treatment System (SBGTS)(BH) autostarted.

3. Unit One and Two Reactor Building Ventilation System (VA) automatically isolated.

4. Group II Containment isolation (JM) valves closed.

5. Group III Containment isolation (JM) valves closed.

Reactor water level was immediately restored and a normal scram recovery was initiated. NRC notification (ENS) was completed at 0215 hours on March 20, 1988, to comply with the requirements of 10 CFR 50.72.

C. APPARENT CAUSE OF EVENT:

This event is being reported according to 10 CFR 50.73(a)(2)(iv), which requires the reporting of any event or condition that results in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

The cause of this event has been attributed to component failure. The packing of the 2B FRV failed, which allowed feedwater to be discharged onto the mezzanine floor. The water and steam affected the control logic for the RFP Vent Fans which are located nearby on the same level and RFP's themselves which are located below the FRV's. This resulted in the false trip alarms prior to the scram. The water from the leak also drained into the cable pans (TY) just below the floor of the mezzanine level. The water then spread through the pan

until it drained into Busses 21 and 22 which the cables feed. The bottom of the pan is sealed except for several small holes in the bottom of the pan to allow condensation to drain out. The excessive amount of water, coupled with the fact that the bottom of the pan is covered by cables, did not allow the water to drain out before spilling into the Busses. Located in cubicle 5 of Bus 21 and Cubicle 10 of Bus 22 are relays (RLY) 2-3241-71 and 2-3241-72 respectively. These normally energized relays, de-energize on reactor vessel high water level (+48 inches) to cause a turbine trip. Moisture from the leak on the 2B FRV caused a short across the contacts of these relays to cause the turbine trip. Following the event the voltages across the terminals for contacts 11 and 12 (turbine trip) and contacts 9 and 10 (alarm) were measured and found to be 18 volts and 75 volts, respectively, indicating a short. Also, ground detector (GDET) indication during the event was reviewed and significant ground activity was found. This would be expected with the moisture intrusion into the Busses.

The cause of the Group I isolation has been attributed to vibration acting on the Main Steam Line Low Pressure switches (63) (
Turbine Building mezzanine level. The vibrations in that area caused by the turbine trip and sudden closure of the turbine stop valves were sufficient to cause the switches to momentarily open to cause the Group I isolation.

Contributing to the failure of the valve packing was a scored valve stem. Inspection by maintenance personnel after the event found evidence of wear on the stem possibly due to misalignment. The valve had last

been repacked on August 12, 1987.

Contributing to this event is the lack of administrative controls to prevent the valve packing from being completely worn before it is replaced. The condition of the valve packing had not gone unnoticed by maintenance and operating personnel but there are no guidelines provided to determine when packing must be replaced in order to avoid packing failure.

Contributing to the spread of the water is that there are no floor drains (DRN) installed in the mezzanine area around the FRV's. Floor drains were originally installed in that area which discharged outside the turbine building. These drains were later sealed to prevent the release of contaminated water to the outside environment. Likewise, there are no curbs installed around the FRV's to control any valve

leakage.

D. SAFETY ANALYSIS OF EVENT:

The health and safety of the public and plant personnel was not affected during this event. The turbine trip and Group I isolation signals associated with this event were false and not the result of actual plant conditions. The Reactor Protection System responded as designed to shutdown the reactor when the turbine tripped. The feedwater system remained operable throughout this event. If the water leakage would have caused a loss of the feedwater system, all Emergency Core Cooling Systems (ECCS) were available to bring the reactor to a safe shutdown condition.

Samples taken by Radiation Chemistry personnel of the mezzanine area determined that there was no potential for airborne contamination and that the water was only slightly radioactive. The area was immediately roped off and access controlled while cleanup commenced to prevent the possible spreading of any contamination.

By reviewing the Turbine Building sump operation records, a conservative estimate of 500 gallons of water was determined to have leaked from the valve.

E. CORRECTIVE ACTIONS:

The immediate corrective actions consisted of repairing the 2B FRV and cleaning up the moisture in electrical circuitry.

The packing in the 2B FRV was replaced under work request Q65263 and the stem polished to remove any raised metal. The packing gland adjustment in all other FRV's was inspected and determined to be adequate.

The smoke (ionization) detectors (DET) installed in the mezzanine were tested and all found to be operable except for two detectors which were then replaced with new per work requests Q65265 and Q65269.

The protective relays in Busses 21 and 22 were inspected by Operational Analysis Department (OAD) personnel for signs of moisture and dried as necessary under work request Q65267. Electrical Maintenance (EM) personnel drained cable pans, inspected breakers and wiring, and cleaned and dried the equipment under work request Q65264. Voltages across the affected contacts were measured and found to have returned to normal. The ground detection system also returned to normal as the circuitry was dried out.

The following items were not completed prior to unit startup but require further action to reduce the chance of recurrence.

1. Disassemble, inspect and repair as necessary the 2B FRV per work request Q63809 during the Unit Two Refuel Outage which began April 10, 1988. Efforts will be made to determine the reason for the scored valve stem. Replace the existing valve packing with live-load packing. (Nuclear Tracking System (NTS) number 2652008801501).

2. Install vibration isolators (VB) on the Steamline Low Pressure Group I instruments during the Unit Two Refuel Outage. This is to be completed under modification MO4-2-87-071 (NTS 2652008801502).

3. Develop administrative guidance for operators to use to determine when packing replacement is necessary to prevent packing failure (NTS 2652008801503).

4. Evaluate existing turbine building mezzanine area drain system to determine if additional drains or water barriers should be installed (NTS 2652008801504).

5. Evaluate installing covers on the affected cable pans to prevent water from spilling into pan (NTS 2652008801505).

6. Revise operator round sheets to require an operator to inspect FRV area once per shift. This should aid preventing any future failures (NTS 2652008801506).

F. PREVIOUS EVENTS:

There have been no previously reported events since January 1984 in which a leaking valve packing has led to a turbine trip and reactor scram because of moisture on turbine trip relaying. There are two previous occurrences since January 1984 in which a Group I isolation has occurred as a result of instrument vibration during a turbine trip. These two events are recorded in LER 254/85-006 and LER 265/86-012.

G. COMPONENT FAILURE DATA:

Valve 2-642B is an 18 inch drag valve manufactured by Babcock and Wilcox Control Components, Inc., model No.B209-12-18P9-13NJ41. A search of the Nuclear Plant Reliability Data System (NPRDS) found no other

reports of packing of a FRV completely failing, although there are numerous reports involving only minor packing leaks.

ATTACHMENT # 1 TO ANO # 8804270237 PAGE: 1 of 1

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RLB-88-124

April 11, 1988

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Reference: Quad-Cities Nuclear Power Station
Docket Number 50-265, DPR-30, Unit Two

Enclosed please find Licensee Event Report (LER) 88-005, Revision 00, for Quad-Cities Nuclear Power Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(iv), which requires the reporting of any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature, including the Reactor Protection System.

Respectfully,
COMMONWEALTH EDISON COMPANY
QUAD-CITIES NUCLEAR POWER STATION
/s/ R. L. Bax
R. L. Bax
Station Manager

RLB/MSK/e
Enclosure

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